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Total Hip Replacement for Neck of Femur Fracture: Comparing Outcomes with Matched Elective Cohort

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Abstract

Introduction: Current literature suggests that total hip replacement (THR) is superior to hemiarthroplasty (HA) for neck of femur fracture in selected group of patients. The outcomes of THR undertaken for trauma setting remain unclear when comparing with elective THR. We compared the outcomes of THR trauma cohort with best-matched elective cohort.

Methods: We retrospectively reviewed 102 patients that underwent THR due to trauma from 2011 to 2013. We had access to 90 cases with complete records. Another 90 matched elective cases were obtained from local arthroplasty database. The elective cases were matched for gender, surgical approaches, surgeon's grade, types of implant, patient's age at operation date of +/- 5 years and operation date of +/- 60 days. Subsequently, the selection criteria were relaxed to patient's age at operation date of +/- 10 years and operation date of +/- 60 days. Unmatched cases were excluded. Complications and death rate were compared.

Results: The average age for both cohorts was 70 years. The trauma cohort had statistically significant lower BMI and longer hospital stay (p = 0.001). The Functional Comorbidity Index (FCI) and Charlson Age

Comorbidity Index (CACI) were the same for both cohorts, reflecting an active patient selection for THR in our centre. The trauma cohort had higher surgical complication rate (9% *vs* 4%), particularly higher dislocation rate (7% *vs* 1%); and higher medical complication rate (32% *vs* 6%). These were consistent with the literature. Contrary to literature, the trauma cohort had six dislocations that five of them were done via anterolateral approach. Among the eight trauma cases with surgical complications, six cases were performed by trainees. The cause of surgical complications remains unclear due to the nature of retrospective study. The trauma cohort had higher death rate than the elective cohort (14% *vs* 4%), with one post-operative cardiac arrest in the trauma cohort. The rest were non-orthopaedic related deaths, ranging between four months to four years.

Conclusion: A more robust way of selecting trauma patients for THR is warranted to reduce morbidity and mortality. Follow-up for the trauma cohort is warranted, as the patients are likely to outlive the implants.

(350 words)

Keywords: Neck of femur fractures, total hip replacement, matching cohort, outcomes

Introduction

With a reversing ageing pyramid and an increasing incidence of osteoporosis, hip fracture is an established public health concern globally(1, 2). It is estimated that 80,000 hip fractures are treated every year in United Kingdom(3). The management of neck of femur fractures (NOF#) includes internal fixation, hemiarthroplasty (HA) and total hip replacement (THR). The debate about which is the most optimum treatment option for NOF# has been on-going for decades(4-7). Nikolopoulos *et al.* prospectively reviewed NOF# patients who underwent internal fixation and revealed that displaced NOF# had a higher rate of avascular necrosis than non-displaced NOF#(8). Despite the relatively high rate of avascular necrosis, the authors also suggested that only few of patients with avascular necrosis actually had disabling symptoms and that can be converted to THR subsequently(8). Tidermark *et al.* reviewed ninety NOF# patients who were treated with internal fixation and revealed that the quality of life was worse in patients with a displaced femoral neck fracture than in those with an undisplaced fracture despite the fractures had healed uneventfully(9).

When considering a displaced NOF#, the treatment options and outcomes become more uncertain(10). Fisher *et al.* performed a retrospective analysis on 3,423 patients aged ≥ 65 years with NOF# treated with open reduction internal fixation, HA and THR; and concluded that there were no difference in the 30-days mortality rate(11). Two randomised controlled trials have compared the outcomes between internal fixation and THR for displaced NOF#, and further concluded that THR can provide better hip function and associated with significantly less reoperations without increasing mortality(12, 13). Recent evidence also suggests that THR is associated with superior functional result, lower re-operation rate but higher dislocation rate than HA(6, 14-16). Therefore, the common consensus is that if the patient is fit and healthy, most surgeons will perform a THR rather than a HA.

Most studies have compared the surgical and functional outcomes between THR and HA for NOF#, for which THR has been reported to have reliably excellent results(14, 15). However, it is not yet clear whether the results of the operation undertaken for trauma setting are as excellent as elective setting. Anakwe *et al.* selected 100 trauma THR patients and were matched for age and sex with 300 elective THR patients(17). The authors showed that the THRs that were undertaken for displaced hip fractures can give equivalent functional outcomes to the THRs that were undertaken electively(17). To date, there are no gold standard age limits or co-morbidities exclusion criteria that can assist surgeons in selecting patients for THR. The practical question raised by trauma surgeons is: who will do well after the THR?

This study aims to compare the outcomes of trauma cohort treated with THR with an exact case match of gender, surgical approach and level of surgical experience with the addition of the best possible age and implant matching elective cohort.

Method

With Caldicott approval, we retrospectively reviewed a consecutive of NOF# patients who underwent THR from 2011 to 2013. The matched elective patients were obtained from local arthroplasty audit group. The elective cohort was gender, surgical approach and main surgeon's level exact matched; with the addition of the best possible age and implant matching with the trauma cohort.

The selection of the elective cases was done in two stages. In the first stage, the elective cases were matched for gender, surgical approaches, surgeon's grade, types of implant, patient's age at operation date of +/- 5 years and operation date of +/- 60 days. For those cases that were unmatched after the first stage, the matching criteria were partially relaxed. In the second stage, the elective cases were matched for gender, surgical approaches, surgeon's grade, patient's age at operation date of +/- 10 years and operation date of +/- 60 days. In both stages, if there were more than one suitable elective matches were found; a single match was subsequently programmatically and randomly selected from all qualified cases. Any unmatched cases after stage two were excluded from the analysis.

Demographic data, medical and surgical complications and death rate of all eligible cases were compared. The Functional Comorbidity Index (FCI) (Appendix 1) was used to measure physical function whereas the Charlson Age Comorbidity Index (CACI) (Appendix 2) was used to predict mortality(18, 19). The mean and standard deviation (STDEV) were used for descriptive purposes. Statistical analysis was performed using Statistical Package for the Social Sciences software (SPSS for Mac, Version 21.0). Data was tested for normal distribution using the Kolmogorov-Smirnov test. The Mann-Whitney test was used to assess the statistical significance between both cohorts. A p-value less than 0.05 were regarded as statistically significant.

Result

There were 102 NOF# patients who underwent THR from 2011 to 2013. Five patients were excluded due to the diagnosis or query of carcinoma diagnosis on admission and seven patients were excluded due to inadequate information for further analysis. We compared a total of 90 trauma cases to a matched elective cohort.

Patient demographics are shown in Table 1. The average age for both cohorts was 70 years. The trauma cohort had statistically significant lower BMI and longer length of hospital stay, with p-value of 0.001 respectively. The average FCI and CACI were the same for both cohorts. The details of associated comorbidities for both cohorts are shown in Table 2. The elective cohort had more obese patients with joint arthritis than the trauma cohort. The implant details are shown in Table 3 and Table 4. The Exeter and CPT/Trilogy systems were commonly used in our trust.

The details of the medical and surgical outcomes are shown in Figure 1, Figure 2 and Table 5. The trauma cohort had a higher medical complication rate than the elective cohort (p = 0.001). The most common medical complications occurred in trauma cohort was renal complications, followed by respiratory and wound complications. The trauma cohort had higher surgical complication rate, particularly higher dislocation rate. In the trauma cohort, we had six dislocations in total, with five of them were done via anterolateral approach. Out of the six dislocations, the trainees did undertake four of the THRs and three of them were via anterolateral approach. We only had one dislocation in the elective cohort and it was done via anterolateral approach, by the consultant.

Among the eight trauma cases with surgical complications, six cases were performed by trainees, resulted in two periprosthetic fracture and four dislocation complications. All elective cases with surgical complications were performed by consultants. At one-year, we had one re-operation in each cohort, which are stem revision for periprosthetic fracture in the elective cohort and posterior lip augmentation device (PLAD) insertion for recurrent dislocation in the trauma cohort. The trauma cohort had a higher death rate than the elective cohort (14 % *vs* 4%; p = 0.022) ranging between four months, secondary to massive myocardial infarction with no previous risk factors; to four years secondary to non-orthopaedic related cancer. We had one post-operation cardiac arrest due to severe chest sepsis in the trauma cohort. The surgery was performed by consultant via anterolateral approach. We had 6% one-year mortality rate in the trauma cohort and 1% one-year mortality rate in the elective cohort. All deaths were non-orthopaedic related deaths.

Discussion

Despite the ever increasing literature on the management of NOF#, the optimal treatment remains uncertain. To-date, there are not many studies designed to compare the outcomes between sliding hip screws and cancellous screws for NOF#, as most literature have focused on the outcomes between internal fixation and THR(20). Furthermore, clinical trials with small sample sizes and poor data quality are common in orthopaedic literature(21). The Fixation Using Alternative Implants for the Treatment of Hip Fractures (FAITH) and the Hip Fracture Evaluation with Alternatives of Total Hip Arthroplasty versus Hemiarthroplasty (HEALTH) trials are two meticulously designed on-going trials that can address the current issues regarding the preferred treatment modality for NOF#(20, 22).

Despite the inconclusive evidence within the literature, we do have increasingly more evidence to suggest that THR has superior functional outcomes for selected patients with displaced hip fractures, which this discussion will focus on(15, 16, 23). It is well known that hip fracture surgery can have significant associated clinical and social cost implications(24). The length of hospital stay for the trauma cohort was longer than the elective cohort, which is consistent to the literature(25). In the trauma cohort where majority of the patients do not have previous functional impairment or hip pathology, as expected, they would need longer length of rehabilitation hospital stay after the traumatic event. Phenomenological researches have demonstrated that patients' psychological status and perceptions can have an impact on their rehabilitation outcomes(26, 27). The sudden loss of independence and physical limitations are major challenges for patients to participate in physical rehabilitation(27). Appropriate clinical and nursing care management should be prioritised after hip fracture to ensure optimal recovery.

Postoperative complications may affect up to 20% of patients with hip fracture and the incidence of acute kidney injuries (AKI) among patients undergoing arthroplasty for NOF# ranges between 16% to 24.4% in the literature(24, 28). Our trauma cohort had a higher medical complications rate (32%), but a lower renal complications rate (10%) than the literature. Postoperative AKI is often multifactorial and maybe caused by pre-, peri-, and postoperative factors(28); which we cannot addressed in this study due to inadequate documentation from the nature of retrospective study.

Some literature suggested that THR has a higher dislocation rate than HA for hip fractures(29). However, there are reports that suggest otherwise. Blomfeldt *et al.* performed a randomised controlled trial to compare the hip function and outcome between bipolar HA and THR for displaced intracapsular fractures of the femoral neck in elderly patients(30). They found better hip function in THR with no increase in the complication rate, including the dislocation rate(30). The matched cohort study performed by Anakwe *et al.* showed that there was a dislocation rate of 2%, a deep infection rate of 2% and an early revision rate of 2% in THR done in trauma setting(17). Our trauma cohort had a higher dislocation rate than the study performed by Anakwe *et al.*(17). However, our dislocation rate was within the range in reported literature(31) and we had a lower re-operation rate than the reported literature(17).

Contrary to the literature(31, 32), majority of our dislocation cases were done via anterolateral approach. In this study, trainees have higher surgical complication rate. There is evidence in literature to support better outcomes when an experienced surgeon performed the hip fracture surgery(33). However, there is no direct association reported between the surgeon's grade and the incidence of postoperative complications(33). Some people might argue that the

THR done by trainee are associated with a higher incidence of dislocation than the THR done by consultant, due to the disrupted anatomy secondary to fracture and the difference in experiences(34). We could not confirm this finding and in our department; trainees always assisted by consultants. Furthermore, in the modern surgical training era, trainees are always trained in a structured and supervised environment. Importantly, our dislocation rate was within reported range(31). In majority of the cases, the cause of surgical complications remains unclear, but it is probably multifactorial.

A successful THR would outlive the patient. Hip fracture has a high associated risk of mortality(35), but only 6% of the patients in the trauma cohort had died at 1 year, which was consistent with the literature(17). Furthermore, all deaths in this study were non-orthopaedic related. Our study did highlight higher medical and surgical complications in the trauma cohort, but again, these were consistent with the literature(28, 31). Some authors have suggested that positive predictors such as young age, independent mobility, cognitive function and physical fitness are likely to indicate survival and better postoperative function(17, 29). Importantly, the FCI and CACI were the same for both cohorts in our study. This is a reflection of active patient selection for THR in our centre.

The authors acknowledge that the current study has certain limitations. Firstly, this is a retrospective study and data analysis relies on the accurate recordkeeping on the medical notes by medical staffs during the event. Secondly, we did not assess the functional outcomes in the trauma cohort, both preoperatively and postoperatively. It is inherently difficult to assess the functional outcomes for THR done in trauma setting. A direct comparison of

Harris Hip Scores between both cohorts cannot be made, as it is not possible to obtain the functional data prior to the injury for the trauma cohort.

To our knowledge, our study is the most extensively matched study cohort available in the current literature. Anakwe *et al.* selected 100 NOF# patients and they were matched for age and sex with 300 patients who underwent elective THR(17). On the other hand, our study has an exact gender, surgical approach and main's surgeon level; with the addition of the best possible age and implant matching. We were unable to exact matched for age, which is a potential weakness of this study. Despite that, our study has more closely matched than current literature. The more exact comparison we can obtain, the more accurate complication profile we can get.

In conclusion, our study highlighted a higher medical, surgical complications and death rate in the trauma cohort, though these were consistent with the literature. Hence we would recommend these cases to be done by hip surgeons or under their direct supervision to reduce technical complications. Follow-up for the trauma cohort similar to the elective cohort is warranted to investigate the long-term outcomes of this special cohort of patient, as these patients are likely to outlive the implants. In addition, a more robust way of selecting trauma patients for THR is warranted to reduce morbidity and mortality.

(2274 words)

References

1. Dhanwal DK, Dennison EM, Harvey NC, Cooper C. Epidemiology of hip fracture: Worldwide geographic variation. Indian J Orthop. 2011;**45**(1):15-22.

2. Hopley C, Stengel D, Ekkernkamp A, Wich M. Primary total hip arthroplasty versus hemiarthroplasty for displaced intracapsular hip fractures in older patients: systematic review. BMJ (Clinical research ed). 2010;**340**:c2332.

3. Baker PN, Salar O, Ollivere BJ, Forward DP, Weerasuriya N, Moppett IK, et al. Evolution of the hip fracture population: time to consider the future? A retrospective observational analysis. BMJ Open. 2014;**4**(4):e004405.

4. Baker RP, Squires B, Gargan MF, Bannister GC. Total Hip Arthroplasty and Hemiarthroplasty in Mobile, Independent Patients with a Displaced Intracapsular Fracture of the Femoral Neck2006 2006-12-01 00:00:00. 2583-9 p.

5. Gjertsen JE, Lie SA, Fevang JM, Havelin LI, Engesaeter LB, Vinje T, et al. Total hip replacement after femoral neck fractures in elderly patients : results of 8,577 fractures reported to the Norwegian Arthroplasty Register. Acta Orthop. 2007;**78**(4):491-7.

6. Su EP, Su SL. Femoral neck fractures: a changing paradigm. Bone Joint J. 2014;**96-B**(11 Supple A):43-7.

7. Probe R, Ward R. Internal Fixation of Femoral Neck Fractures. Journal of the American Academy of Orthopaedic Surgeons. 2006;**14**(9):565-71.

8. Nikolopoulos KE, Papadakis SA, Kateros KT, Themistocleous GS, Vlamis JA, Papagelopoulos PJ, et al. Long-term outcome of patients with avascular necrosis, after internal fixation of femoral neck fractures. Injury. 2003;**34**(7):525-8.

9. Tidermark J, Zethraeus N, Svensson O, Tornkvist H, Ponzer S. Quality of life related to fracture displacement among elderly patients with femoral neck fractures treated with internal fixation. J Orthop Trauma. 2002;**16**(1):34-8.

10. Miyamoto RG, Kaplan KM, Levine BR, Egol KA, Zuckerman JD. Surgical management of hip fractures: an evidence-based review of the literature. I: femoral neck fractures. J Am Acad Orthop Surg. 2008;**16**(10):596-607.

11. Fisher MA, Matthei JD, Obirieze A, Ortega G, Tran DD, Carnegie DA, et al. Open reduction internal fixation versus hemiarthroplasty versus total hip arthroplasty in the elderly: a review of the National Surgical Quality Improvement Program database. The Journal of surgical research. 2013;**181**(2):193-8.

12. Blomfeldt R, Tornkvist H, Ponzer S, Soderqvist A, Tidermark J. Comparison of internal fixation with total hip replacement for displaced femoral neck fractures. Randomized, controlled trial performed at four years. J Bone Joint Surg Am. 2005;**87**(8):1680-8.

13. Chammout GK, Mukka SS, Carlsson T, Neander GF, Stark AW, Skoldenberg OG. Total hip replacement versus open reduction and internal fixation of displaced femoral neck fractures: a randomized long-term follow-up study. J Bone Joint Surg Am. 2012;**94**(21):1921-8.

14. Gao H, Liu Z, Xing D, Gong M. Which is the best alternative for displaced femoral neck fractures in the elderly?: A meta-analysis. Clin Orthop Relat Res. 2012;**470**(6):1782-91.

15. Burgers PT, Van Geene AR, Van den Bekerom MP, Van Lieshout EM, Blom B, Aleem IS, et al. Total hip arthroplasty versus hemiarthroplasty for displaced femoral neck fractures in the healthy elderly: a meta-analysis and systematic review of randomized trials. International orthopaedics. 2012;**36**(8):1549-60.

16. Zi-Sheng A, You-Shui G, Zhi-Zhen J, Ting Y, Chang-Qing Z. Hemiarthroplasty vs Primary Total Hip Arthroplasty For Displaced Fractures of the Femoral Neck in the Elderly: A Meta-Analysis. The Journal of Arthroplasty. 2012;**27**(4):583-90.

17. Anakwe RE, Middleton SD, Jenkins PJ, Butler AP, Aitken SA, Keating JF, et al. Total hip replacement in patients with hip fracture: a matched cohort study. The journal of trauma and acute care surgery. 2012;**73**(3):738-42.

18. Groll DL, To T, Bombardier C, Wright JG. The development of a comorbidity index with physical function as the outcome. Journal of Clinical Epidemiology. 2005;**58**(6):595-602.

19. Neuhaus V, King J, Hageman MG, Ring DC. Charlson Comorbidity Indices and In-hospital Deaths in Patients with Hip Fractures. Clinical Orthopaedics and Related Research. 2013;**471**(5):1712-9.

20. FAITH Investigators. Fixation using alternative implants for the treatment of hip fractures (FAITH): design and rationale for a multi-centre randomized trial comparing sliding hip screws and cancellous screws on revision surgery rates and quality of life in the treatment of femoral neck fractures. BMC musculoskeletal disorders. 2014;**15**:219.

21. Khan M, Aleem IS, Poolman RW. Fixation versus primary replacement of displaced femoral neck fractures in the elderly. Indian J Orthop. 2011;**45**(1):23-6.

22. Bhandari M, Devereaux PJ, Einhorn TA, Thabane L, Schemitsch EH, Koval KJ, et al. Hip fracture evaluation with alternatives of total hip arthroplasty versus hemiarthroplasty (HEALTH): protocol for a multicentre randomised trial. BMJ Open. 2015;**5**(2).

23. van den Bekerom MP, Hilverdink EF, Sierevelt IN, Reuling EM, Schnater JM, Bonke H, et al. A comparison of hemiarthroplasty with total hip replacement for displaced intracapsular fracture of the femoral neck: a randomised controlled multicentre trial in patients aged 70 years and over. The Journal of bone and joint surgery British volume. 2010;**92**(10):1422-8.

24. Carpintero P, Caeiro JR, Carpintero R, Morales A, Silva S, Mesa M. Complications of hip fractures: A review. World Journal of Orthopedics. 2014;**5**(4):402-11.

25. Lombardi B, Paci M, Nannetti L, Moretti S, Maritato M, Benelli G. Total hip arthroplasty after hip fracture or osteoarthritis: are there differences in characteristics and outcomes in the early rehabilitative stage? Orthopedic nursing. 2014;**33**(1):43-7.

26. Archibald G. Patients' experiences of hip fracture. Journal of advanced nursing. 2003;**44**(4):385-92.

27. Olsson LE, Nystrom AE, Karlsson J, Ekman I. Admitted with a hip fracture: patient perceptions of rehabilitation. Journal of clinical nursing. 2007;**16**(5):853-9.

28. Ulucay C, Eren Z, Kaspar EC, Ozler T, Yuksel K, Kantarci G, et al. Risk Factors for Acute Kidney Injury After Hip Fracture Surgery in the Elderly Individuals. Geriatric Orthopaedic Surgery & Rehabilitation. 2012;**3**(4):150-6.

29. Monzón DG, Iserson KV, Jauregui J, Musso C, Piccaluga F, Buttaro M. Total Hip Arthroplasty for Hip Fractures: 5-Year Follow-Up of Functional Outcomes in the Oldest Independent Old and Very Old Patients. Geriatric Orthopaedic Surgery & Rehabilitation. 2014;**5**(1):3-8.

30. Blomfeldt R, Tornkvist H, Eriksson K, Soderqvist A, Ponzer S, Tidermark J. A randomised controlled trial comparing bipolar hemiarthroplasty with total hip replacement for displaced intracapsular fractures of the femoral neck in elderly patients. The Journal of bone and joint surgery British volume. 2007;**89**(2):160-5.

31. Enocson A, Hedbeck CJ, Tidermark J, Pettersson H, Ponzer S, Lapidus LJ. Dislocation of total hip replacement in patients with fractures of the femoral neck. Acta Orthop. 2009;**80**(2):184-9.

32. Skoldenberg O, Ekman A, Salemyr M, Boden H. Reduced dislocation rate after hip arthroplasty for femoral neck fractures when changing from posterolateral to anterolateral approach. Acta Orthop. 2010;**81**(5):583-7.

33. Scottish Intercollegiate Guidelines Network. SIGN 111: Management of hip fracture in older people. In: Network SIG, editor. 2009.

34. Palan J, Gulati A, Andrew JG, Murray DW, Beard DJ, group tEs. The trainer, the trainee and the surgeons' assistant: CLINICAL OUTCOMES FOLLOWING TOTAL HIP REPLACEMENT. Journal of Bone & Joint Surgery, British Volume. 2009;**91-B**(7):928-34.

35. Le Manach Y, Collins G, Bhandari M, et al. OUtcomes after hip fracture surgery compared with elective total hip replacement. JAMA. 2015;**314**(11):1159-66.

Conflict of Interest

No benefits in any form have been received or will be received from a commercial party related directly or indirectly to the subject of this article.

Table
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Tables

Table 1: Patient demographics.

Variables	**Trauma**		**Elective**	
	n	**Mean ± STDEV**	**n**	**Mean ± STDEV**
Gender (Female : Male)	90	66:24	90	66:24
Approach (Anterolateral : Posterior)	90	69:21	90	69:21
Surgeon Grade (Consultant : Trainee)	90	50:40	90	50:40
Age	90	70 ± 11	90	70 ± 9
BMI (kg/m^2)	56	25.1 ± 4.5	90	28.9 ± 5.6
Hospital Stay (days)	77	9 ± 5	90	6 ± 5
Functional Comorbidity Index	84	2 ± 2	90	2 ± 1
Charlson Age Comorbidity Index	86	4 ± 2	90	4 ± 1

Table 2: Comorbidities.

Comorbidities	**Fracture (n)**	**Elective (n)**	**P-value**
Arthritis	22	90	**0.001**
Osteoporosis	13	8	0.247
Asthma	3	5	0.471
COPD	5	4	0.733
Angina	3	3	0.999
Congestive heart failure	5	6	0.756
MI	5	2	0.249
Parkinson	1	0	0.317
Stroke / TIA	5	4	0.733
PVD	0	4	0.044
DM	7	4	0.352
Ulcer / hernia / reflux	17	27	0.084
Depression	12	5	0.075
Anxiety	4	2	0.408
Vision impairment	8	5	0.389
Hearing impairment	2	1	0.562
Back pain	8	10	0.620
Obesity	9	30	**0.001**
Solid tumour	5	1	0.098
Liver disease	0	2	0.562
Diabetes with end organ damage	2	1	0.317
Lymphoma	1	0	0.233
Chronic kidney disease	4	8	0.233
Connective tissue disease	1	0	0.317
Metastasis solid tumour	1	0	0.317

Table 3: The stem used.

Stem	**Trauma (n)**	**Elective (n)**
Exeter	41	45
CPT	43	44
CLS	2	0
Accolade	1	0
M/L Taper	0	1
Not recorded	3	0

Table 4: The acetabular system.

Cup	Trauma (n)	Elective (n)
Exeter	40	26
Continuum	7	7
Trident	4	13
Trilogy	20	30
ZCA	19	10
Charnley Elite Plus Ogee	0	2
Maxera	0	1
Not Recorded	0	1

Table 5: The medical and surgical outcomes in both trauma and elective cohort.

Outcomes	Trauma (%)	Elective (%)	p-value
Surgical Complication	9	4	0.233
Medical Complication	32	6	**0.001**
Dislocation	7	1	0.055
Death rate	14	4	**0.022**
1-year Mortality	6	1	0.633

Figures

Figure 1: The surgical complications.

Figure 2: The medical complications.

Figure 1
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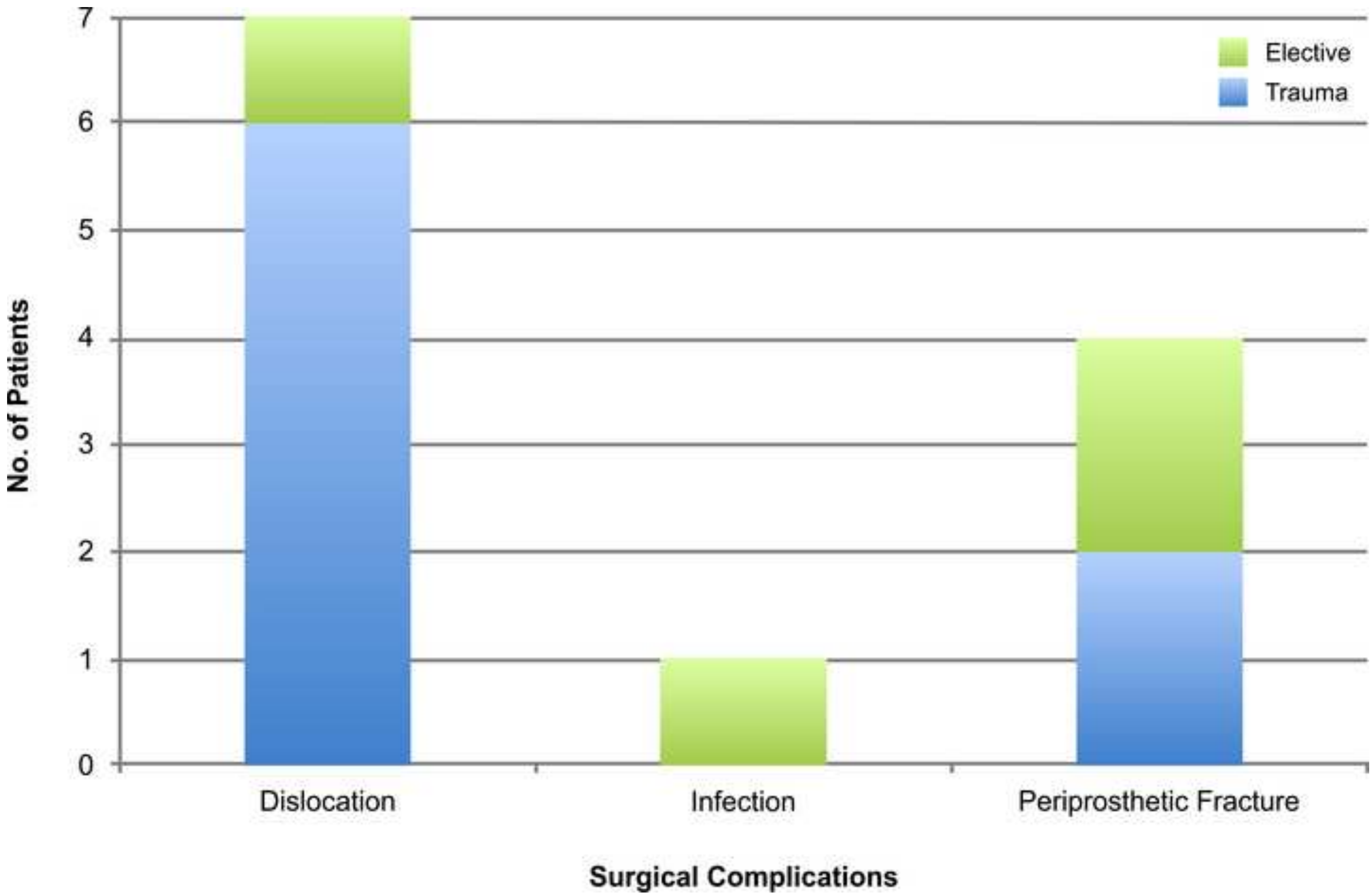

Figure 2
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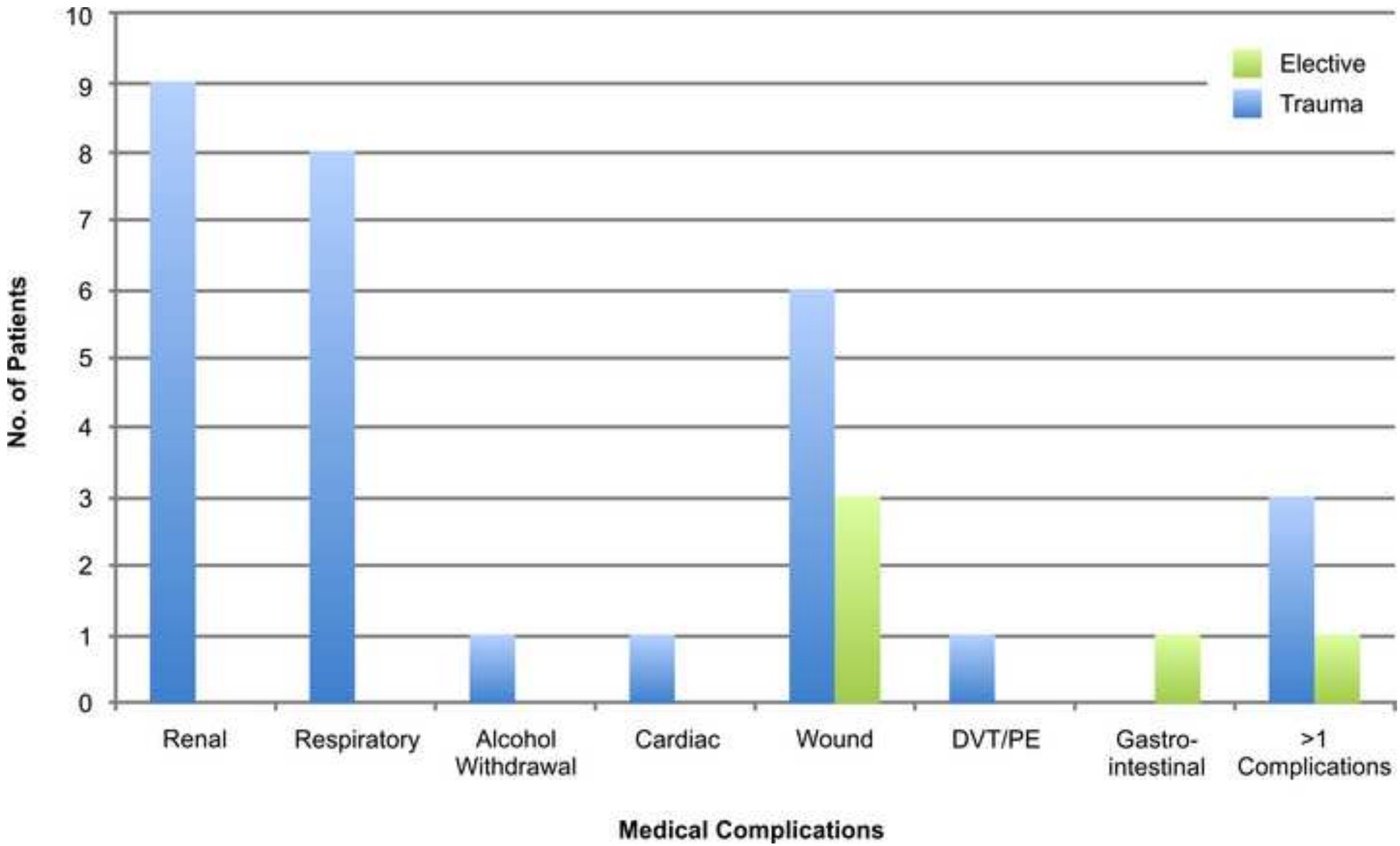

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Supplementary Materials

Click here to download Supplementary Materials: NOF_Appendices.docx